## MOTION PICTURES OF WEATHER MAPS: A REPORT OF PROGRESS.[1]

By J. WARREN SMITH.

[Author's abstract.]

A project is well underway to illustrate the movement of storms and general weather conditions across the country by means of motion pictures.

Scenarios have been outlined to show: (1) The movement of a West Indian hurricane from the Atlantic into and across the Gulf of Meixco, its curving path onto the mainland and across the United States, and its movement across the Great Lakes and down the St. Lawrence to the North Atlantic; (2) the movement of cold waves; (3) heavy rainfall and floods; (4) heavy snowstorms; (5) local thunderstorms and tornadoes; and (6) comparisons of the climate of different sections of the country.

The movement of the hurricanes and of other weather conditions will be shown by weather maps drawn for each 15 minutes. Each map will be photographed from 6 to 48 times. Proper explanatory heads will be made and the weather maps will be accompanied by a suitable collection of motion pictures to illustrate the weather conditions and effects. These will consist in part of storm damage, waves on the coast, orchard heating, snow scenes, etc.

It is believed that these pictures will be of high educational value and show the work of the Weather Bureau and the marked value of its forecasts and warnings.

[1] Presented before the joint meeting of the Am. Meteorlogical Soc., Assoc. of Am. Geographers and Nat'l Council of Geog. Teachers, St. Louis, Mo., Dec. 31, 1919.

## DETERMINATION OF THE NORMAL TEMPERATURE BY MEANS OF THE EQUATION OF THE SEASONAL TEMPERATURE VARIATION AND OF A MODIFIED THERMOGRAPH RECORD.[1]

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[From authors' abstract.]

The daily and annual march of normal temperature in the arid west may be approximated from a pair of formulas where bulky tables are not convenient.

The normal air temperature is a periodic function of the time, there being two prominent periods, a 24-hour and an annual period. The mean daily temperature for the different days of the year for Utah was plotted and the following empirical equation for the curve was obtained by the Fourier series:

$$T=48.5-22.2 \cos (\theta-19°54')-2.7 \cos 2 (\theta-149°5') -1.0 \cos 3 (\theta-17°3') \ldots .$$

in which $T$ represents the mean annual temperature and $\theta$ the time expressed in degrees, e. g., April 1 = 90°, July 1 = 180°, etc. The same curve for widely separated places in the interior of the United States are nearly identical in shape, and, when superimposed on the curve for Utah, in the most extreme case, projected but 2 degrees above the maximum and 2 degrees below the minimum. The first term in the above equation is the mean annual temperature for the place considered, and simply displaces the curve up and down on the page, while the amplitude is determined by the difference in temperature between winter and summer, and varies in different places in the interior of the United States from the Utah value by from 1 to 4 degrees F. The above equation, therefore, is of general application.

The curve representing the diurnal temperature change modifies its shape gradually each day flattening out as winter approaches. We find that the daily variation in temperature is about twice as much in summer as in winter. However, the ratio of the hourly temperatures is nearly constant whatever day of the year is selected, e. g., the ratio of the maximum to the mean (on the Fahrenheit scale) is approximately a constant for all days of the year. The equation for this daily curve is as follows:

$$P=97.3-25.2 \cos (\theta-67°10')+3.7 \cos 2 (\theta-38°)- 1.5 \cos 3 (\theta-23°16') \ldots .$$

in which $P$ represents in per cent of the mean daily temperature of the hour of which $\theta$ is the time of day expressed in degrees; e. g., 6 a. m. = 90°, noon = 180°, etc. This equation is also of general application. Using the above method, it is found that in the arid west the chances are one in six that the actual temperature will differ from the computed value by less than 2° F., two in five that it will be as large as 5° F., one in four that it will be as much as 10° F., and one in seven that it will be as much as 15° F. Cyclones and anticyclones are the main causes of these departures.

### DISCUSSION.

The discussion brought out clearly that although these formulas could be used to advantage in the absence of tables to compute probable temperatures on some future date, the results of such a computation would be in no sense a long-range forecast.

Dr. West called attention to the effect of the curved time lines on a thermograph sheet in making the afternoon decline of temperature appear much steeper than the morning rise, whereas for several hours on either side of the maximum the two are of practically the same order.

[1] Presented before Am. Meteorological Soc., St. Louis, Mo., Dec. 31, 1919.

## *DR. JOHN AITKEN.*[1]

The death of Dr. John Aitken, LL. D., F. R. S., on November 13 at the age of 80 is announced. Dr. Aitken was best known to meteorologists for his researches concerning dust particles in the atmosphere and their functions as nuclei of cloudy condensation, and for his theory of the formation of dew. His other investigations covered a wide field.—*Met'l Office Circular, Dec. 1, 1919, p. 4.*

Probably the name of John Aitken will be associated more particularly with the discovery of the place of dust in the functions of the atmosphere, and to the revision of the theory of dews, but his services to experimental meteorology are much more extensive. His valuable researches on the measurement of air temperature have never been fully appreciated by meteorologists and it is to be feared that they are little known. They deal almost exhaustively with the effect of radiation on thermometer bulbs of different size and surface, with the effect of shelter in thermometer screens, the influence of a current of air flowing over the bulbs, and the possibility of securing such a current by the use of a chimney of appropriate size and suitable surface. * * *

[1] A longer discussion of the life and work of Dr. John Aitken is to be found in *Nature* (London), Nov. 27, 1919, pp. 337-338.